alcohol-preserved specimens of all three genera mentioned, from numerous locations throughout their ranges, likewise exhibited the characteristic fluorescence.

Some animals fluoresce under U-V light because of the presence of specific minerals; others, because of the presence of certain organic compounds; still others fluoresce because of the presence of specific microorganisms. Certain evidence now available to us suggests that this phenomenon occurs in endodontids because of the presence of two or more as yet unidentified organic compounds in the mucus of these snails. Preliminary spectrophotometric work indicates a significant difference in the chemistry of the compounds; fluorescence peaks appear between 275 and 300 nm, and again between 350 and 400 nm, in mucus samples from all three genera investigated. We have also found, however, that the mucus of all living endodontids in our collection invariably contains bacteria of the genus *Pseudomonas*. We are testing the role, if any, that these bacteria play in the production of fluorescence in the snails. At the same time, several other avenues are being explored and we expect to report on these investigations in a subsequent paper.

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AROAPYRGUS COLOMBIENSIS N. SP. (GASTROPODA: HYDROBIIDAE), SNAIL INTERMEDIATE HOST OF *PARAGONIMUS CALIENSIS* IN COLOMBIA[1]

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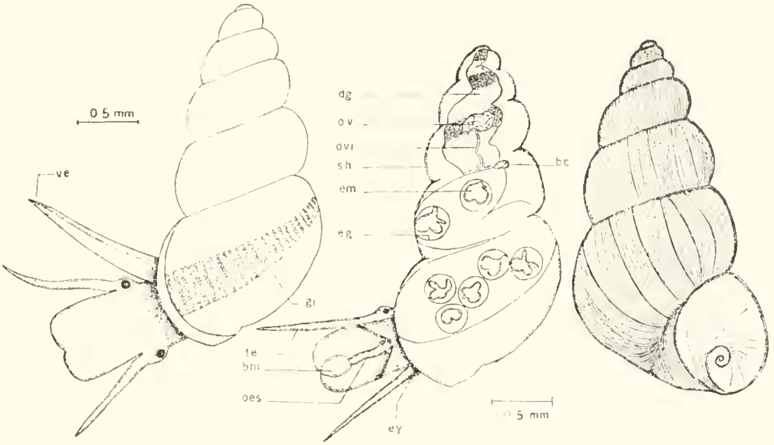
During investigations of paragonimiasis in Colombia (Little and Epler, unpublished report) a hydrobiid snail was found to be naturally infected with a new species of *Paragonimus*, *P. caliensis*



bm	buccal mass	ey	eye	ovi	oviduct
bu	bursa copulatrix	gi	gill	sh	shell
dg	digestive gland	oes	oesophagus	te	tentacle
eg	egg capsule	ov	ovary	ve	verge
em	embryo				

Fig. 1. *Aroapyrgus colombiensis,* showing shell and operculum. Fig. 2. Female specimen with the reproductive organs. Fig. 3. Male specimen showing the verge. The gill shows through the shell.

Little, 1968. The snails were collected from swift, shallow streams 2 to 6 feet wide, and with fairly steep banks. The snails were most readily collected in quiet pools on dead decaying leaves. Laboratory colonies were successfully established, with maple leaves being used as food. The availability of field and laboratory-reared snails permitted a study of the systematics of this new hydrobiid belonging to the genus *Aroapyrgus,* to which *A. colombiensis* is assigned.

Holotype: Delaware Museum No. 41542. Paratypes: Delaware Museum No. 41543; Field Mus. Nat. Hist. 168647; Acad. Nat. Sci. Phila. 321818. Type locality: Tributaries of Rio Pichinde, near Pichinde, Municipio de Cali, Departamento de Valle de Cauca, Colombia.

Methods

Specimens were relaxed with menthol before they were fixed in Bouin's or FAA. Morphological studies were carried out with some

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shells of these snails, while others were used for *in toto* mounts, after being stained with Semichon's carmine. Because of the small size of the snail it was found necessary to study its morphological details from serial paraffin sections, stained with Ehlrich's hematoxylin and eosin. The radula and operculum were studied in glycerin preparations.

Description of the snail

The Shell (Fig. 1)—Field collected specimens are covered with a dark brownish deposit. In laboratory-reared specimens, and a few field ones, however, the shell is smooth, light yellowish in color and translucent. Usually there is no size difference between the males and females. Very few females, however, are slightly broader than the males of the same age. The shell in the fully developed specimens has 5 to 6 evenly rounded whorls. The body whorl is rapidly increasing; some of the growth lines are raised in the form of very fine ridgelets. Fine microscopic ridgelets are also present on the body whorl, and on the penultimate whorl. The protoconch consists of one whorl only. The sutures are deeply impressed; the umbilicus is open, and relatively large. The aperture is ovoid and almost vertical; the peristome is simple and sharp, and is slightly flaring in the palatal region. The columellar margin is simple. The operculum is thin, corneus and paucispiral. Average shell measurements from 15 specimens in millimeters are as follows: height 3.1, width 1.6, aperture height 1, and aperture width 0.8.

The Animal (Figs 2 and 3)—The foot is spatulate, truncate anteriorly, and bluntly pointed posteriorly. The tentacles are slender on both sides of the moderately pigmented snout. The gill of *Aroapyrgus colombiensis* consists of about 30 lamellae and starts near the mantle collar, where it is wide, and narrows down posteriorly under the roof of the mantle, through which it shows very clearly.

The radula is similar to that of other hydrobiids (Baker 1930, Berry 1943, Thompson 1968). The central tooth has from 12 to 15 cusps on its reflected margin, and 3 basal cusps. The lateral has 9 to 13 cusps, the 6th from the inside (the mesocone) is twice as large as any of the others, and the tooth is attached by an elongate base which extends obliquely laterad and posteriad from its squarish body. The handle is elongate and narrow. The inner marginal tooth is spoon-shaped, its concave blade carries about 25 to 35 small cusps on the reflection. The outer marginal is thinner and more slender than the inner, and has much smaller cusps which are numerous, and are not easily seen except in fresh preparations.

Description of the reproductive organs is based on reconstructions from serial paraffin sections. In the male the testis is located at the level of the third whorl, and is embedded among the tubules of the digestive gland. Seminal vesicles are located at the beginning of the vas deferens. The latter continues as a narrow duct until it opens into the verge. A large prostate gland extends transversely about the level of the penultimate whorl. The verge arises inside a circular fold to the right of the mid-dorsal line. As is characteristic of species belonging to this genus the verge (Fig. 3) is large, simple (devoid of any papillae and is unbranched); its terminal half is smaller in diameter than the base. The seminal duct runs along the outer margin of the verge.

In the female (Fig. 2) the ovary is located at the same level as is the testis in the male. The oviduct arises from the ovary as a narrow channel before it enlarges to form a "brood pouch," which is the equivalent of the pallial oviduct in other hydrobiids. A bursa copulatrix and a seminal receptacle open at about the junction of the two parts of the oviduct. Numerous embryos, up to 30, are found in the brood pouch. The active embryos, each with a shell of about one whorl, are located within the egg capsules from which they are apparently released at birth. The birth pore is found in the proximal end of the brood pouch at the mantle collar.

Discussion

Baker (1930) proposed *Aroa* as a subgenus of *Potamopyrgus*, with *P. (Aroa) ernesti vivens* as type. (The species *ernesti* was described as *Hydrobia ernesti* by von Martens 1873, as a subfossil from Lago de Valencia). The reasons Baker gave are that the verge is simpler than in *Potamopyrgus* and *Littoridina*, and still is not bifid, as in *Amnicola* or *Hydrobia (Paludestrina)*. Later, Baker (1931) renamed it *Aroapyrgus*, and *Morrison* (1946) used *Aroapyrgus* as genus with the genotype *Aroapyrgus ernesti vivens* H. B. Baker. According to Morrison (1946) the genus is known to occur from Panama to Cayenne in French Guiana. Some species described under *Amnicola* in the region from Mexico to Costa Rica might also belong to this genus but will remain uncertain until animal characteristics are better known.

Morrison (1946) named and described the species *Aroapyrgus alleei, A. chagresensis* and *A. joseana* from the Panama region.

A. alleei has faintly shouldered whorls, whereas *A. chagresensis* has evenly rounded whorls. *A. joseana* has axially shorter whorls, than the other two species, and can also be distinguished from them by its smaller aperture and narrower conical outline. *A. colombiensis* can be distinguished from the above 3 species by its somewhat turreted spire, by having more whorls (up to 6 rounded ones), and by a narrower aperture. Except for the genus characteristics of the copulatory organ Morrison (1946) did not mention any other anatomical features of his new species. Baker (1930) described *Aroapyrgus ernesti vivens (=Potamopyrgus (Aroa) ernesti vivens)* as a new subspecies from Venezuela. He noted that it was the commonest form in the small streams of central and western Venezuela. *A. colombiensis* differs from *A. ernesti vivens* in the fact that generally there is no sexual dimorphism in the Colombian species contrary to the case with the Venezuelan form. Pilsbry (1935) described *Potamopyrgus laciranus*, as a new species from La Cira formation near Zopffs, La Cira District, Colombia. The shells were found to be abundant in the La Cira hematitic sandstones. The description of the shell of *A. colombiensis* as given in the present paper agrees in the main with that described by Pilsbry.

A note on the nomenclatorial history of this hydrobiid group seems in order. Pilsbry (1891) regarded the two genera *Pyrgophorus* (Ancey) and *Potamopyrgus* (Stimpson) as synonymous. Morrison (1939), however, was of the opinion that *Potamopyrgus* is strictly a New Zealand genus, and that *Pyrgophorus* is found only in the Americas. He also thought that *Lyrodes* (Doering) is a synonym of *Pyrgophorus*. Species belonging to *Aroapyrgus* can be differentiated from species belonging to the latter genera by the characteristics of the verge. The verge is very simple in *Aroapyrgus* spp., whereas it is bifid, and is provided with very distinct papillae in *Pyrgophorus*.

Several hydrobiids have been described from South America under various genera. It is obvious from a review of the literature that further studies are still needed to clarify their taxonomic status. Weyrauch (1963) for example described, on the basis of the shell only, a new species of *Potamopyrgus* from Peru, *P. mirandoi*, and some new species of *Littoridina* from Argentina and Peru. Parodiz (1960) reported from Argentina, a new species of *Lyrodes*, *L. doellojuradoi* whose shells resemble those of *Aroapyrgus* spp. However, their anatomy remains to be studied.

The morphology of various British and European prosobranchs, in particular *Potamopyrgus jenkinsi*, were dealt with in detail by Fretter and Graham (1962). The comparative morphology of the various organ systems of these mollusks were elucidated. The morphology of several hydrobiids was treated by various authors, viz. *Pomatiopsis* spp. by van der Schalie and Dundee (1956), Dundee (1957), van der Schalie and Getz (1962); *Oncomelania nosophora* by Roth and Wagner (1957); *Cochliopa texana* and *Lyrodes cheatumi* by Dundee and Dundee (1969); various hydrobiids from Florida by Thompson (1968). The above reports as well as the present report show the usual hydrobiid morphology and, indicate that generic and specific differences shown are based on details of the structure of certain parts of the genitalia, particularly the verge, and the oviduct. The pallial portion of the oviduct is considerably expanded in the viviparous forms to accommodate the fully developed embryos. Other features of diagnostic value are: the radula, shape of the gill and number of gill lamellae, size of the osphradium, branching of the ovary, and shape of the bursa copulatrix and prostrate gland.

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VARIATION IN THE SHELL OF *MUDALIA POTOSIENSIS* (LEA) (PLEUROCERIDAE) FROM A SINGLE LOCALITY

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A number of workers have attempted to correlate aquatic gastropod shell variation with environmental factors. Wiebe (1926), for example, reported a direct correlation between shell size and shape and exposure to wave action, reporting, however, that differences in obesity index arose via two main avenues: (1) because of apical erosion and (2) because of actual differences in shell size and shape. Several mechanisms underlying apical erosion have been suggested in the literature, from a combination of physical and chemical factors (Jones and Branson, 1964; Goodrich, 1936) to mechanical abrasion by water-borne silt (Bailey, Pearl, and Winsor, 1932, 1933 a). The latter investigators (1933 b) were not able to correlate shell characters with any features of the environment. However, Adams (1915) demonstrated headwaters-to-mouth variation in the shells of *Io,* and Cheatum and Mouzon (1934) found that shells of *Goniobasis comalensis* Pilsbry averaged longer and wider when secured from ponded areas as contrasted